

Unexploded ordnances on construction sites

How to avoid costs, delays and disputes

Unexploded Ordnances, or UXO's, are a legacy of military activity affecting many parts of the UK, both rural and urban.¹ Hundreds of thousands of bombs were dropped across Europe during WWI and WWII, of which at least 10% failed to explode and remain buried in land or underwater. UXO's become more volatile with age and can easily be triggered by heat, shock or vibration. This makes them particularly hazardous for construction works involving any disruption of soil such as piling or earthworks.²



10% of WWI & WWII bombs
dropped failed to explode

A rare occurrence with severe consequences

In the UK, although the risk of discovering UXO's on construction sites is low, the potential consequences on health, safety and environment (HSE) and project cost and schedule are significant.³ The key risks include:

- injury and material damage
- delays and unforeseen costs to projects due to standing time
- site evacuations
- road closures
- reputational damage.⁴

To avoid serious issues down the line, a systematic preliminary risk assessment should be performed wherever the presence of a UXO is suspected on site.⁵

1 CIRIA C681 <https://www.ciria.org/ProductExcerpts/C681.aspx>

2 <https://www.safelaneglobal.com/en/blogs/the-value-of-uxo-services/>

3 CIRIA C681 <https://www.ciria.org/ProductExcerpts/C681.aspx>

4 <https://www.safelaneglobal.com/en/blogs/the-value-of-uxo-services/>

5 CIRIA C681 <https://www.ciria.org/ProductExcerpts/C681.aspx>

What should you do when you discover a UXO hazard on a construction site?

For construction sites where a UXO hazard has been identified, work should not start until an emergency response plan is in place. This should be included in the project's HSE plan and briefed to the site teams.⁶

The UK Federation of Piling Specialists recommends that a UXO Emergency Response Plan (ERP) should cover the following:⁷

- **Identification of appropriate persons responsible:** for implementation of the ERP and to undertake specified roles in case of an incident.
- **Open lines of communication:** at all stages of an emergency event it is important to keep site staff informed of what is happening. Nominated responsible persons should be prepared to provide briefings to the emergency services and, if required, to residents and the media.
- **Build a site evacuation plan:** to identify how the alarm will be raised, location of evacuation routes and muster points.
- **Create a safety cordon:** the size of the exclusion zone will be determined by site conditions and the suspected nature of the object. Appropriate nominated persons should supervise the exclusion zone to ensure that no one re-enters the cordoned-off area.
- **Confirmation of the status of the suspect item:** usually undertaken by the UXO specialist, who may in certain circumstances have been retained on site.

Minimising risk – best practice guidelines

Although there are no regulations in the UK around UXO risk management in construction projects⁸, best practice guidelines are available which are widely used in the industry today: the CIRIA C681 guideline and the Crossrail UXO Risk Assessment.

The Construction Industry Research and Information Association (CIRIA) developed the C681 guideline for construction professionals in the UK to mitigate the risks of UXO hazards.⁹ This guide offers best practice

recommendations for preliminary and detailed risk assessment, risk mitigation and implementation, duties and responsibilities, emergency response planning and involvement of UXO specialists.¹⁰

CIRIA anticipates that most sites in the UK will be identified as having a low probability of containing a UXO hazard and would be excluded from further consideration following the completion of the preliminary risk assessment. However, this is an important initial step to help construction professionals to assess sites with potential UXO risk.¹¹

The Crossrail procedure, developed in 2004 (five years before the publication of CIRIA C681), resembles CIRIA's guidelines in philosophy and consists of the same basic steps.¹² The main differences refer to the later stages of mitigation and clearance of UXO's, where Crossrail does not provide specific plans but CIRIA does. Overall, the similarities between the two procedures are clear and both are widely used on large scale UK infrastructure today. They demonstrate that an effective UXO procedure can be implemented without causing excessive cost or delay to a project.¹³

Who is responsible for managing UXO risks?

The responsibilities of all parties involved in a construction project for UXO risk management are defined by the regulations applicable to the project. For example, on UK projects governed by the Construction (Design and Management) Regulations (CDM), the responsibilities are defined as follows:¹⁴

- **The client** has a legal duty to provide staff and contractors with project-specific health and safety information needed to identify hazards and risks associated with the design and construction work. Where the client lacks adequate knowledge of UXO risk, they are required to seek guidance from suitably qualified advisors.
- **The CDM coordinator** provides the client with a key project advisor in respect of construction health and safety risk management matters, including UXO risk. The appointment of the CDM coordinator does not remove the client's responsibilities regarding health and safety.

6 <https://www.fps.org.uk/content/uploads/2017/05/Unexploded-Explosive-Ordnance-UXO.pdf>

7 <https://www.fps.org.uk/content/uploads/2017/05/Unexploded-Explosive-Ordnance-UXO.pdf>

8 <https://www.safelaneglobal.com/en/blogs/ciria-c681-unexploded-ordnance-uk-construction/>

9 CIRIA was formerly known as the Construction Industry Research and Information Association. They are a member-based research and information organisation who publish reports and technical papers covering building and civil engineering as well as transport and utilities infrastructure. <https://www.thenbs.com/PublicationIndex/documents/details?Pub=CIRIA&DocID=290326>

10 <https://www.thenbs.com/PublicationIndex/documents/details?Pub=CIRIA&DocID=290326>

11 <https://www.fps.org.uk/content/uploads/2017/05/Unexploded-Explosive-Ordnance-UXO.pdf>

12 <https://www.icevirtuallibrary.com/doi/pdf/10.1680/geng.11.00005>

13 <https://www.icevirtuallibrary.com/doi/pdf/10.1680/geng.11.00005>

14 <https://www.safelaneglobal.com/en/blogs/ciria-c681-unexploded-ordnance-uk-construction/>

- **The designer** is responsible for identifying and eliminating hazards and reducing risks by supplying adequate information regarding the design and any unusual or hidden risks. This information must be communicated appropriately so that other parties involved in the works are aware of any residual risks that were not eliminated by the design process and in an appropriate timescale to enable other parties to act upon the information as required.
- **The principal contractor** is responsible for preparing the construction phase plan and for health and safety during the construction phase of works. They must ensure the potential risks from encountering UXO's have been suitably addressed. This includes having sufficient appropriately trained staff on-site at all times to ensure the effective implementation of the emergency response plan and ensuring adequate arrangements have been made with the public emergency services to enable them to respond appropriately to any potential UXO incident.
- Finally, **the contractors** (including piling and groundworks contractors) are responsible for providing the principal contractor with any information relating to their work that might affect health and safety. This will include information relevant to any changes in site practices or site conditions that may impact potential risk from UXO. They must also comply with directions from the principal contractor.¹⁵

Avoiding delays, excess cost and disputes

Despite their rare occurrence, the presence of a UXO hazard on a construction site causes inevitable HSE, cost and delay impacts to a project. It is paramount that an adequate risk management process is implemented early in the project lifecycle, usually before a piling or ground improvement contractor has become involved, and have involved clients, their advisors and principal contractors.¹⁶ Although an early UXO assessment might be time-consuming, it is the best way to reduce risks of significant cost overruns, delays and disputes on responsibilities down the line.

Case study

LONDON CITY AIRPORT EXPANSION PROJECT

The London City Airport expansion project involved the construction of a new aircraft taxiway supported by 1,100 piles in King George V Dock, where the project teams uncovered an unexploded ordnance. The client hired a team of divers and surveyors to check over 400 locations on the dock bed to ensure that the site is safe from debris prior to piling works.¹⁷

The UXO survey contractor provided "ALARP" (as low as reasonably possible) clearance certificates for each of the pile locations.¹⁸ The UXO risk was known at the design stage and was accounted for during the planning application stage (i.e. desktop assessment). One design consideration was to increase the pile spacings and reduce the number of piles needing investigation. This ensured minimal delays to the main contractor and their piling subcontractor and avoided disputes related to responsibilities.

As part of this process, a 500kg UXO was uncovered in February 2018 on-site.¹⁹ Thanks to the well-defined project responsibilities and emergency procedures, the construction works experienced a minimal halt of two days in the affected perimeter until the Royal Navy removed the UXO from the site for a controlled detonation off the shore of Shoeburyness.²⁰

Apart from affecting construction works, the discovery of the UXO also led to the closure of the airport and the implementation of a 214m cordon for two working days.²¹ This impact was minimised thanks to the implementation of an emergency response plan by the principal contractor.

**This case study is for example purposes only and does not relate to the services provided by FTI Consulting.*

15 <https://www.fps.org.uk/content/uploads/2017/05/Unexploded-Explosive-Ordnance-UXO.pdf>

16 CIRIA C681 <https://www.ciria.org/ProductExcerpts/C681.aspx>

17 <https://www.bechtel.com/projects/london-city-airport/>

18 https://www.safelaneglobal.com/en/case_studies/london-city-airport-bomb-clearance/

19 https://www.safelaneglobal.com/en/case_studies/london-city-airport-bomb-clearance/

20 https://www.safelaneglobal.com/en/case_studies/london-city-airport-bomb-clearance/

21 <https://media.londoncityairport.com/ww2-ordnance-discovery-at-london-city-airport/>

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